

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Virendra K. Budhraja

Title: METHOD AND APPARATUS FOR SWITCHING AND
MANAGING BANDWIDTH IN AN ATM/TDM NETWORK
CROSS-CONNECT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

PRELIMINARY AMENDMENT

Prior to the initial review of this non-provisional utility continuation patent application entitled "Method and Apparatus for Switching and Managing Bandwidth in an ATM/TDM Network Cross-Connect" by Virendra K. Budhraja, please amend the application as follows:

IN THE SPECIFICATION

The specification is amended at Page 1 as follows. Please refer to the attached sheet showing a marked-up version of the amendment to the specification.

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Application Serial No. 09/208,626, filed December 8, 1998, by Virendra K. Budhraja and entitled "Method and Apparatus for Switching and Managing Bandwidth in an ATM/TDM Network Cross-Connect."

IN THE CLAIMS

For the convenience of the Examiner, all pending claims of the present Application are shown below whether or not an amendment has been made. Please refer to any attached sheets showing a marked-up version of any amendments to the specification and claims.

1. (Canceled).

2. (Canceled).

3. (Canceled).

4. (Canceled).

5. (Canceled).

6. (Canceled).

7. (Canceled).

8. (Canceled).

9. (Canceled).

10. (Canceled).

11. (Canceled).

12. (Canceled).

13. **(New)** A switching node, comprising:

a network interface operable to receive an asynchronous transfer mode (ATM) cell comprising header bytes, information storage bytes, and synchronous network traffic stored in the information storage bytes;

a switching subsystem operable to perform asynchronous transfer mode (ATM) switching; and

a memory subsystem operable to store bandwidth allocation information for the switching node, the bandwidth allocation information enabling the switching subsystem to communicate the ATM cell to another switching node using the network interface without individually switching the information storage bytes of the ATM cell.

14. **(New)** The switching node of Claim 13, wherein the ATM cell is one of a plurality of ATM cells, the switching subsystem is further operable to perform synchronous network switching, and the processor is operable to receive synchronous network traffic from the network interface and to store the synchronous network traffic in the ATM cells.

15. **(New)** The switching node of Claim 13, wherein the switching subsystem is further operable to perform synchronous network switching, and the processor is further operable to retrieve the synchronous network traffic from the ATM cell and to communicate the synchronous network traffic synchronously to a subscriber termination of an ATM network using the network interface.

16. **(New)** The switching node of Claim 13, wherein the bandwidth allocation information describes allocated bandwidth and available bandwidth for a plurality of switching nodes, and the bandwidth allocation information further comprises a destination identifier identifying a destination switching node for the ATM cell

17. **(New)** The switching node of Claim 13, wherein:

the synchronous network traffic stored in the information storage bytes of the ATM cell comprises a plurality of DS-0s;

the bandwidth allocation information comprises a destination identifier identifying a destination switching node for the ATM cell; and

each DS-0 in the ATM cell is associated with the destination identifier.

18. **(New)** The switching node of Claim 13, wherein the bandwidth allocation information comprises:

a destination identifier identifying a destination switching node for the ATM cell;

a virtual path identifier (VPI);

a virtual channel identifier (VCI);

a bandwidth map comprising a plurality of bandwidth block identifiers; and

a selected bandwidth block identifier allocated to the ATM cell.

19. **(New)** A method for transporting synchronous network traffic across an asynchronous transfer mode (ATM) network, comprising:

receiving a network request for a cross-connection at a switching node in an ATM network, the network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for supporting the cross-connection;

retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

allocating one or more bandwidth blocks for the cross-connection;

updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

updating the bandwidth allocation information to include the destination switching node;

receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

communicating the ATM cell using the bandwidth allocation information without individually switching the information storage bytes.

20. **(New)** The method of Claim 19, wherein the ATM cell is one of a plurality of ATM cells and the method further comprises:

receiving the synchronous network traffic from a network termination of a synchronous network; and

storing the synchronous network traffic in the information storage bytes of one or more of the plurality of ATM cells.

21. (New) The method of Claim 19, further comprising:
determining if sufficient bandwidth blocks are available for the bandwidth requirements of the cross-connection; and
if not enough of the bandwidth blocks are available, communicating a network response to a network managing station indicating that not enough of the bandwidth blocks are available, and waiting until sufficient bandwidth blocks become available before allocating the one or more bandwidth blocks to the cross-connection.

22. (New) The method of Claim 19, wherein the bandwidth allocation information describes allocated bandwidth and available bandwidth for a plurality of switching nodes.

23. (New) The method of Claim 19, wherein:
the synchronous network traffic stored in the information storage bytes of the ATM cell comprises a plurality of DS-0s; and
each DS-0 in the ATM cell is associated with the destination identifier.

24. (New) The method of Claim 19, wherein the bandwidth allocation information comprises:
the destination identifier;
a virtual path identifier (VPI);
a virtual channel identifier (VCI); and
a selected bandwidth block identifier allocated to the ATM cell.

25. (New) Software embodied in a computer readable medium and operable to perform the following steps:

receiving a network request for a cross-connection at a switching node in an ATM network, the network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for supporting the cross-connection;

retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

allocating one or more bandwidth blocks for the cross-connection;

updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

updating the bandwidth allocation information to include the destination switching node;

receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

communicating the ATM cell using the bandwidth allocation information without individually switching the information storage bytes.

26. (New) The software of Claim 25, wherein the ATM cell is one of a plurality of ATM cells and the method further comprises:

receiving the synchronous network traffic from a network termination of a synchronous network; and

storing the synchronous network traffic in the information storage bytes of one or more of the plurality of ATM cells.

27. (New) The software of Claim 25, further comprising:
determining if sufficient bandwidth blocks are available for the bandwidth requirements of the cross-connection; and
if not enough of the bandwidth blocks are available, communicating a network response to a network managing station indicating that not enough of the bandwidth blocks are available, and waiting until sufficient bandwidth blocks become available before allocating the one or more bandwidth blocks to the cross-connection.

28. (New) The software of Claim 25, wherein the bandwidth allocation information describes allocated bandwidth and available bandwidth for a plurality of switching nodes.

29. (New) The software of Claim 25, wherein:
the synchronous network traffic stored in the information storage bytes of the ATM cell comprises a plurality of DS-0s; and
each DS-0 in the ATM cell is associated with the destination identifier.

30. (New) The software of Claim 25, wherein the bandwidth allocation information comprises:

- the destination identifier;
- a virtual path identifier (VPI);
- a virtual channel identifier (VCI); and
- a selected bandwidth block identifier allocated to the ATM cell.

31. (New) A system for transporting synchronous network traffic across an asynchronous transfer mode (ATM) network, comprising:

means for receiving a network request for a cross-connection at a switching node in an ATM network, the network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for supporting the cross-connection;

means for retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

means for allocating one or more bandwidth blocks for the cross-connection;

means for updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

means for updating the bandwidth allocation information to include the destination switching node;

means for receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

means for communicating the ATM cell using the bandwidth allocation information without individually switching the information storage bytes.

32. (New) A method for establishing a cross-connection for synchronous network traffic transported in an asynchronous transfer mode (ATM) network, comprising:

 determining a network path for a cross-connection, the network path comprising a first switching node and a second switching node;

 storing bandwidth allocation information for the first and second switching nodes;

 communicating a first network request for the cross-connection to the first switching node, the first network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for the cross-connection;

 receiving, in response to the first network request, updated bandwidth allocation information for the first switching node;

 updating the stored bandwidth allocation information for the first switching node; and

 communicating a second network request for the cross-connection to the second switching node, the second network request comprising the destination identifier, the bandwidth requirements for the cross-connection, and the updated bandwidth allocation information for the first switching node.

33. (New) The method of Claim 32, wherein determining the network path for the cross-connection comprises:

 determining a plurality of network paths from an origination to a destination, each network path specifying one or more switching nodes and each network path having sufficient bandwidth to support the cross-connection;

 selecting from the plurality of network paths one or more shortest network paths comprising a least number of switching nodes; and

 selecting from the one or more shortest network paths the shortest network path having the highest bandwidth.

34. (New) The method of Claim 32, wherein the method further comprises:

 receiving a network response indicating that insufficient bandwidth is available for the cross-connection; and

 selecting an alternative network path for the cross-connection.

35. **(New)** The method of Claim 32, wherein the steps are performed at a network managing station.

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36. **(New)** Software embodied in a computer readable medium and operable to perform the following steps:

determining a network path for a cross-connection, the network path comprising a first switching node and a second switching node;

storing bandwidth allocation information for the first and second switching nodes;

communicating a first network request for the cross-connection to the first switching node, the first network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for the cross-connection;

receiving, in response to the first network request, updated bandwidth allocation information for the first switching node;

updating the stored bandwidth allocation information for the first switching node; and

communicating a second network request for the cross-connection to the second switching node, the second network request comprising the destination identifier, the bandwidth requirements for the cross-connection, and the updated bandwidth allocation information for the first switching node.

37. **(New)** The software of Claim 36, wherein determining the network path for the cross-connection comprises:

determining a plurality of network paths from an origination to a destination, each network path specifying one or more switching nodes and each network path having sufficient bandwidth to support the cross-connection;

selecting from the plurality of network paths one or more shortest network paths comprising a least number of switching nodes; and

selecting from the one or more shortest network paths the shortest network path having the highest bandwidth.

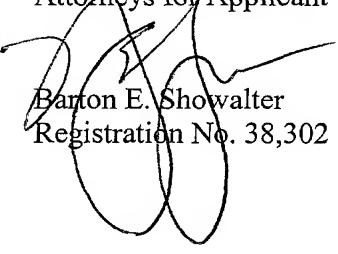
38. **(New)** The software of Claim 36, wherein the method further comprises receiving a network response indicating that insufficient bandwidth is available for the cross-connection; and selecting an alternative network path for the cross-connection.

REMARKS

Early and favorable acceptance of this continuation application is respectfully requested.

Respectfully submitted,

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Dated: Nov. 7, 2001

Marked-Up Version of Specification and Claim Amendments

For the convenience of the Examiner, all claims have been presented whether or not an amendment has been made. The specification and claims have been amended as follows:

IN THE SPECIFICATION

Please amend the specification at Page 1, line 1, by inserting the following:

--CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Application Serial No. 09/208,626, filed December 8, 1998, by Virendra K. Budhraja and entitled "Method and Apparatus for Switching and Managing Bandwidth in an ATM/TDM Network Cross-Connect."—

IN THE CLAIMS

Please amend the Claims as follows.

Please cancel Claims 1-12 without prejudice.

Please add the following new claims.

--13. (New) A switching node, comprising:

a network interface operable to receive an asynchronous transfer mode (ATM) cell comprising header bytes, information storage bytes, and synchronous network traffic stored in the information storage bytes;

a switching subsystem operable to perform asynchronous transfer mode (ATM) switching; and

a memory subsystem operable to store bandwidth allocation information for the switching node, the bandwidth allocation information enabling the switching subsystem to communicate the ATM cell to another switching node using the network interface without individually switching the information storage bytes of the ATM cell.

14. **(New)** The switching node of Claim 13, wherein the ATM cell is one of a plurality of ATM cells, the switching subsystem is further operable to perform synchronous network switching, and the processor is operable to receive synchronous network traffic from the network interface and to store the synchronous network traffic in the ATM cells.

15. **(New)** The switching node of Claim 13, wherein the switching subsystem is further operable to perform synchronous network switching, and the processor is further operable to retrieve the synchronous network traffic from the ATM cell and to communicate the synchronous network traffic synchronously to a subscriber termination of an ATM network using the network interface.

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17. **(New)** The switching node of Claim 13, wherein:

- the synchronous network traffic stored in the information storage bytes of the ATM cell comprises a plurality of DS-0s;
- the bandwidth allocation information comprises a destination identifier identifying a destination switching node for the ATM cell; and
- each DS-0 in the ATM cell is associated with the destination identifier.

18. **(New)** The switching node of Claim 13, wherein the bandwidth allocation information comprises:

- a destination identifier identifying a destination switching node for the ATM cell;
- a virtual path identifier (VPI);
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- a bandwidth map comprising a plurality of bandwidth block identifiers; and
- a selected bandwidth block identifier allocated to the ATM cell.

19. **(New)** A method for transporting synchronous network traffic across an asynchronous transfer mode (ATM) network, comprising:

receiving a network request for a cross-connection at a switching node in an ATM network, the network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for supporting the cross-connection;

retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

allocating one or more bandwidth blocks for the cross-connection;

updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

updating the bandwidth allocation information to include the destination switching node;

receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

communicating the ATM cell using the bandwidth allocation information without individually switching the information storage bytes.

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storing the synchronous network traffic in the information storage bytes of one or more of the plurality of ATM cells.

21. **(New)** The method of Claim 19, further comprising:
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retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

allocating one or more bandwidth blocks for the cross-connection;

updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

updating the bandwidth allocation information to include the destination switching node;

receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

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26. **(New)** The software of Claim 25, wherein the ATM cell is one of a plurality of ATM cells and the method further comprises:

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storing the synchronous network traffic in the information storage bytes of one or more of the plurality of ATM cells.

27. **(New)** The software of Claim 25, further comprising:
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31. (New) A system for transporting synchronous network traffic across an asynchronous transfer mode (ATM) network, comprising:

means for receiving a network request for a cross-connection at a switching node in an ATM network, the network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for supporting the cross-connection;

means for retrieving from memory bandwidth allocation information for the switching node, the bandwidth allocation information specifying a plurality of bandwidth blocks;

means for allocating one or more bandwidth blocks for the cross-connection;

means for updating the bandwidth allocation information to reflect the allocated bandwidth blocks;

means for updating the bandwidth allocation information to include the destination switching node;

means for receiving an ATM cell comprising header bytes, information storage bytes and synchronous network traffic stored in the information storage bytes; and

means for communicating the ATM cell using the bandwidth allocation information without individually switching the information storage bytes.

32. (New) A method for establishing a cross-connection for synchronous network traffic transported in an asynchronous transfer mode (ATM) network, comprising:

 determining a network path for a cross-connection, the network path comprising a first switching node and a second switching node;

 storing bandwidth allocation information for the first and second switching nodes;

 communicating a first network request for the cross-connection to the first switching node, the first network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for the cross-connection;

 receiving, in response to the first network request, updated bandwidth allocation information for the first switching node;

 updating the stored bandwidth allocation information for the first switching node; and

 communicating a second network request for the cross-connection to the second switching node, the second network request comprising the destination identifier, the bandwidth requirements for the cross-connection, and the updated bandwidth allocation information for the first switching node.

33. (New) The method of Claim 32, wherein determining the network path for the cross-connection comprises:

 determining a plurality of network paths from an origination to a destination, each network path specifying one or more switching nodes and each network path having sufficient bandwidth to support the cross-connection;

 selecting from the plurality of network paths one or more shortest network paths comprising a least number of switching nodes; and

 selecting from the one or more shortest network paths the shortest network path having the highest bandwidth.

34. (New) The method of Claim 32, wherein the method further comprises:

 receiving a network response indicating that insufficient bandwidth is available for the cross-connection; and

 selecting an alternative network path for the cross-connection.

35. (New) The method of Claim 32, wherein the steps are performed at a network managing station.

36. **(New)** Software embodied in a computer readable medium and operable to perform the following steps:

determining a network path for a cross-connection, the network path comprising a first switching node and a second switching node;

storing bandwidth allocation information for the first and second switching nodes;

communicating a first network request for the cross-connection to the first switching node, the first network request comprising a destination identifier specifying a destination switching node and further comprising bandwidth requirements for the cross-connection;

receiving, in response to the first network request, updated bandwidth allocation information for the first switching node;

updating the stored bandwidth allocation information for the first switching node; and

communicating a second network request for the cross-connection to the second switching node, the second network request comprising the destination identifier, the bandwidth requirements for the cross-connection, and the updated bandwidth allocation information for the first switching node.

37. **(New)** The software of Claim 36, wherein determining the network path for the cross-connection comprises:

determining a plurality of network paths from an origination to a destination, each network path specifying one or more switching nodes and each network path having sufficient bandwidth to support the cross-connection;

selecting from the plurality of network paths one or more shortest network paths comprising a least number of switching nodes; and

selecting from the one or more shortest network paths the shortest network path having the highest bandwidth.

38. **(New)** The software of Claim 36, wherein the method further comprises receiving a network response indicating that insufficient bandwidth is available for the cross-connection; and selecting an alternative network path for the cross-connection.--